

# Terrain Attribute Soil Mapping for Functional Property Maps

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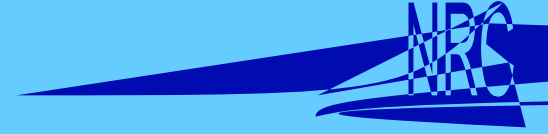
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# Cooperators

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  - Stephen Norm
  - John Allen;
- USDA-ARS, National Soil Erosion Laboratory
  - Diane Stott

# Rationale and Background

- The completion of the initial Soil Survey for the United States is projected around 2010;
- The launching of Web Soil Survey (WSS) and other on-line soil information;
- New high resolution spatial data and spatial analysis software.

# Polygon vs. Raster

Gilpin Soil Value  
Range:  
11 - 15

Zanesville Soil Value  
Range:  
9 – 12

- **Polygons**

- Discreet boundaries
- Broken interconnectedness
- Vague predictions (value ranges)
- Incompatibility with raster-based models
- Simplicity of representation, complexity of interpretation

- **Rasters**

- Fuzzy boundaries
- High degree of interconnectedness
- Specific predictions at specific geographic intervals
- High compatibility with raster models
- Complexity of representation, simplicity of interpretation

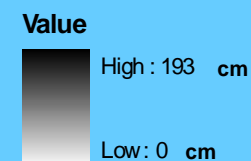


Gilpin Zanesville  
Stendal Gilpin  
Cuba Tilsit  
Steff  
Cuba Gilpin  
Tilsit

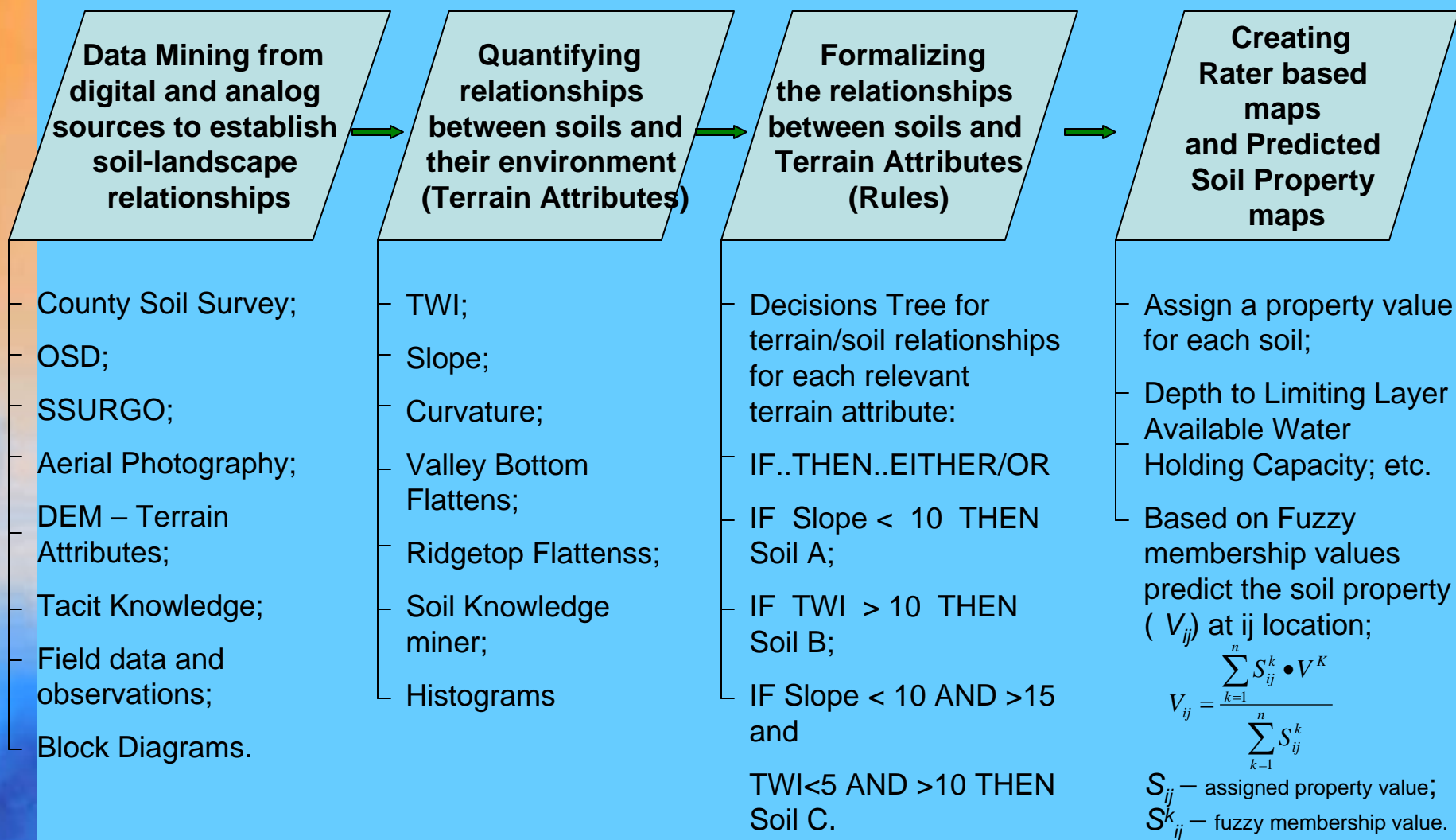
**To Raster Soil Property Maps**

**From Soil Polygon Maps**

**Depth to  
Limiting Layer**

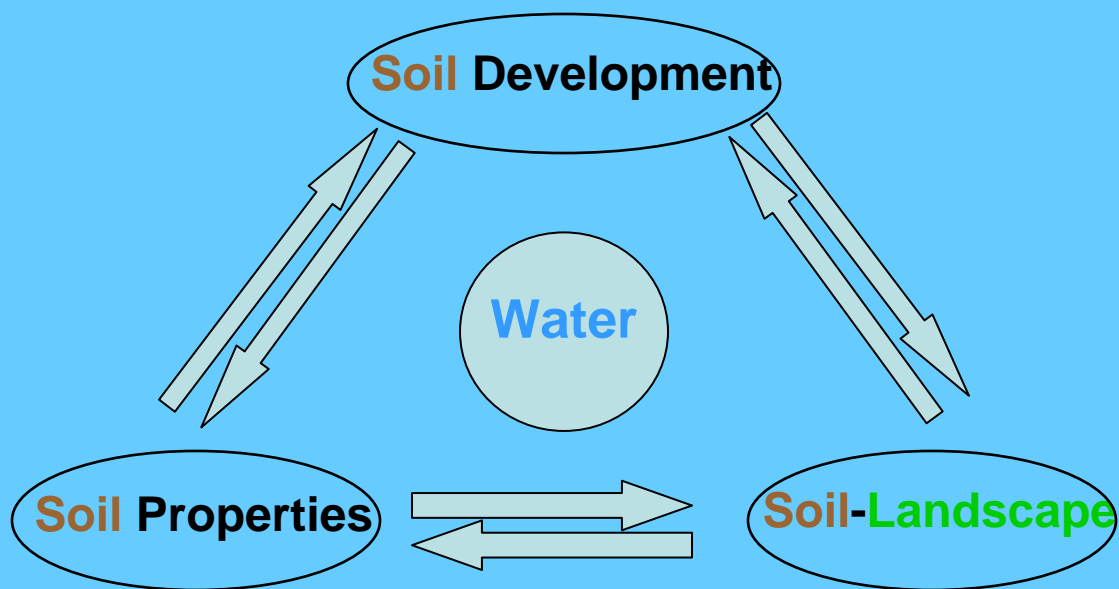


# TASM Processes



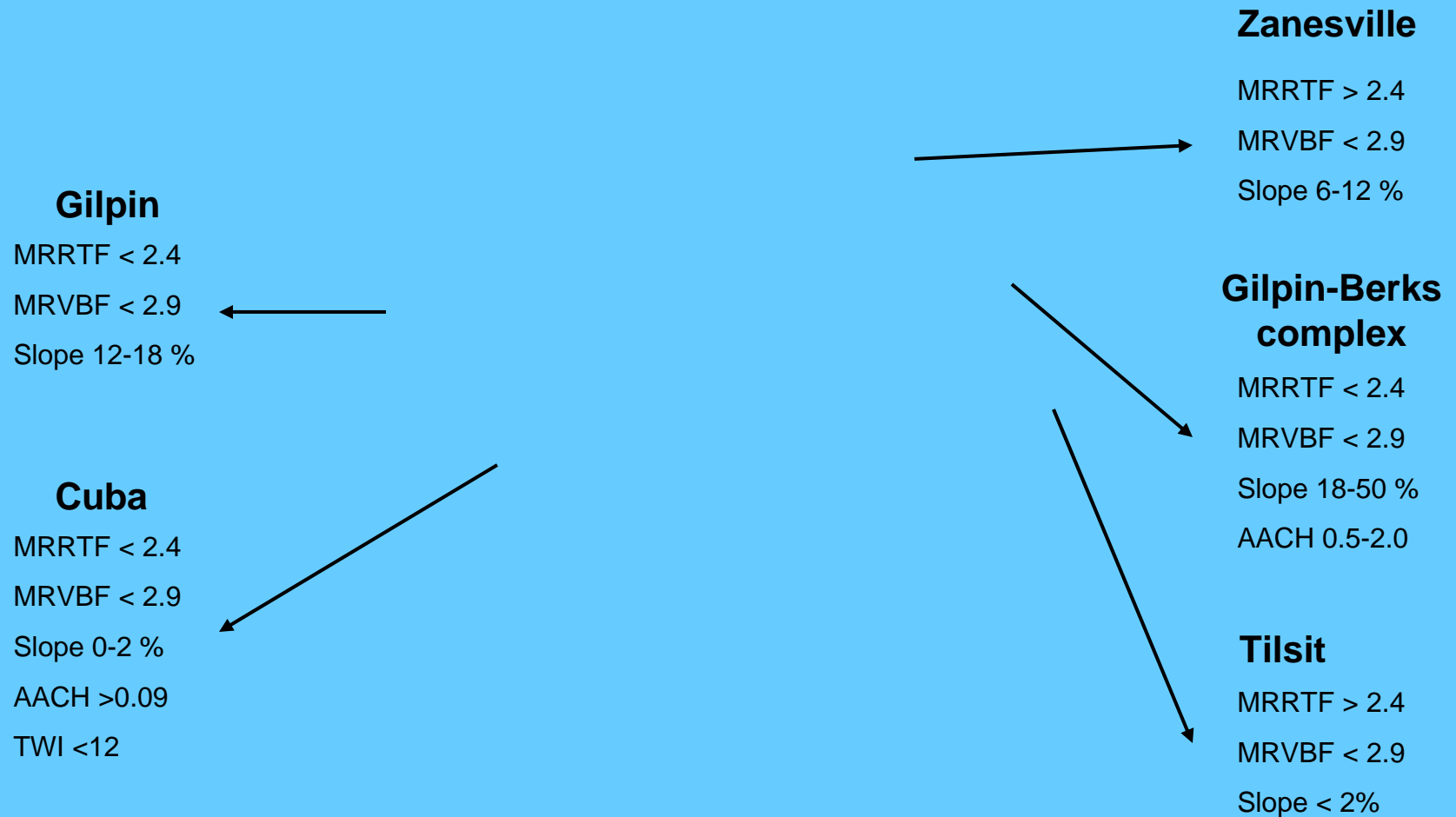
# TASM Principle

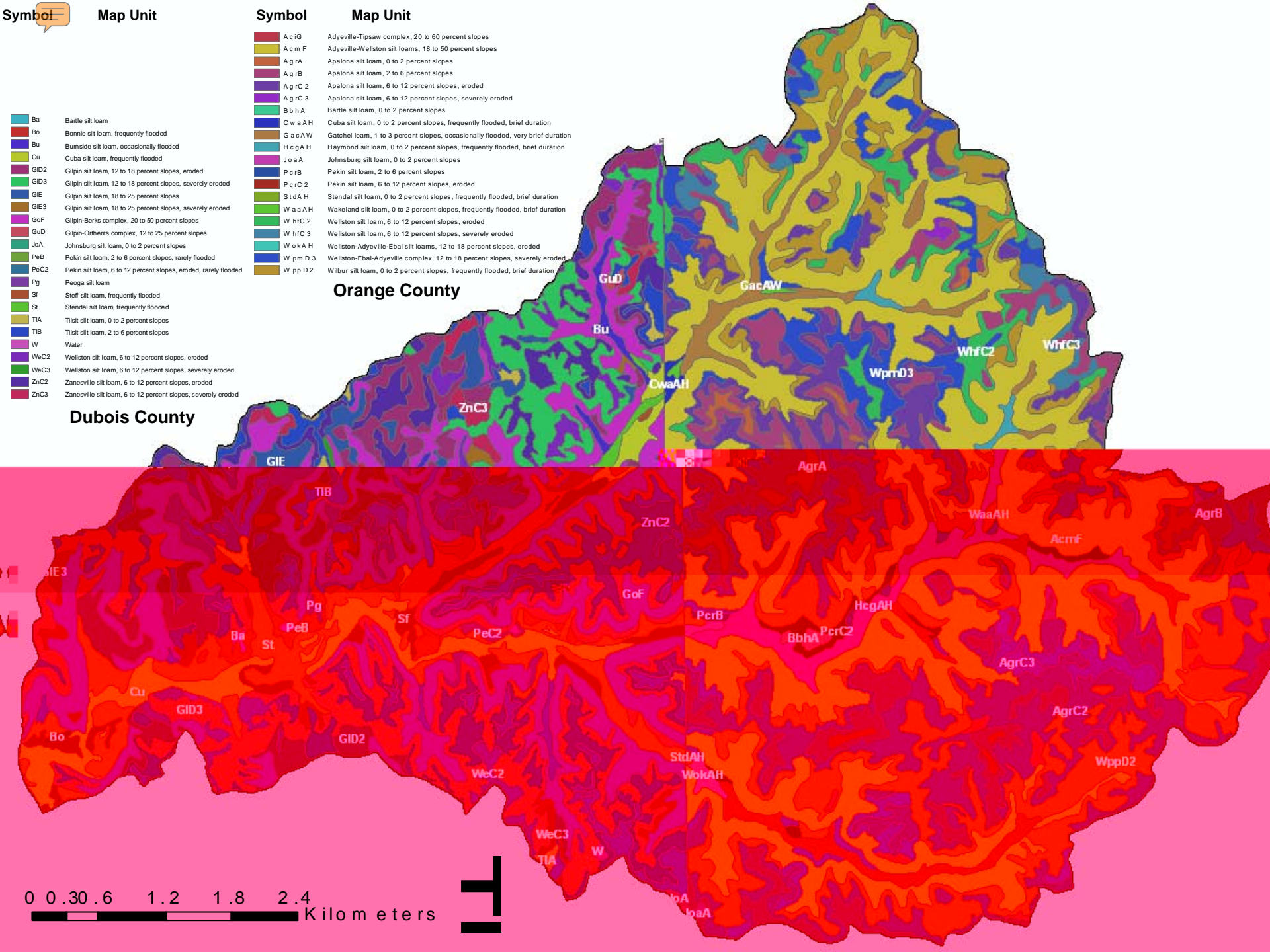
## Soil-Water Relationships



# TASM Principle

# Terrain Attributes Soil Relationships





Map Unit

	Tilsit_Bedford_Apallona_Johbsburg 0-2
	Tilsit_Bedford_Apallona 2-6
	Zanesville_Apallona_Wellston 6-12
	Gilpin_Wellstone_Adyeville_Ebal 12-18
	Gilpin_Ebal_Berks 18-50
	Pekin_Bartle 2-12
	Cuba 0-2
	Steff_Stendal_Burnside_Wakeland 0-2
	Rock Outcrop_Sttep Slope > 50

0 0.30 .6 1.2 1.8 2.4  
Kilometers



- Tilsit\_Bedford\_Apallona\_Johbsburg 0-2
- Tilsit\_Bedford\_Apallona 2-6
- Zanesville\_Apallona\_Wellston 6-12
- Gilpin\_Wellstone\_Adyeville\_Ebal 12-18
- Gilpin\_Ebal\_Berks 18-50
- Pekin\_Bartle 2-12
- Cuba 0-2
- Steff\_Stendal\_Burnside\_Wakeland 0-2
- Rock Outcrop\_Sttep Slope > 50





Depth (cm)



High : 200.

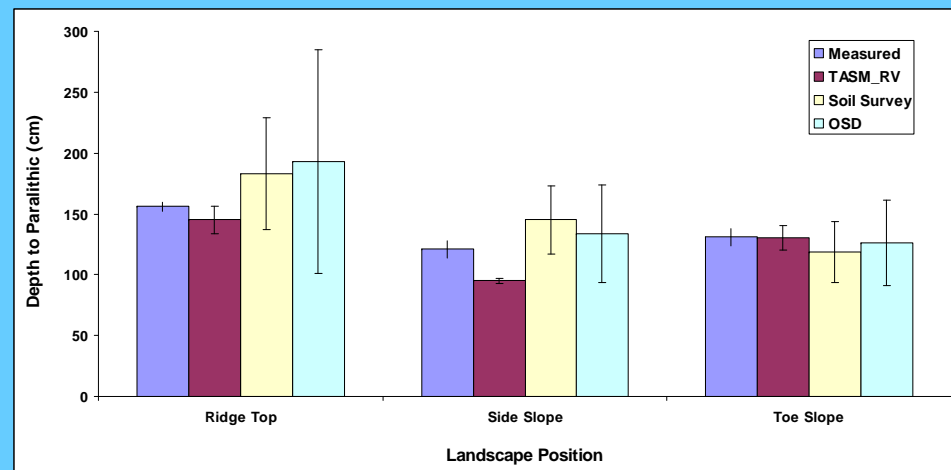
Low : 20



# Validation

## Analysis of Variance Results

Source of Variability	F Value	P Value	Statistical Differences
Landscape position (LP)	19.6	< 0.0001	Significant
Method (TASM vs. Measured)	4.22	0.04	Marginal
LP*Method	1.72	0.18	Not significant



BmA	Blount silt loam, 0 to 2 percent slopes
BmB2	Blount silt loam, 2 to 4 percent slopes, eroded
Bs	Brookston silty clay loam
Ca	Crosby silt loam, 0 to 2 percent slopes
CsA	Crosby silt loam, 2 to 4 percent slopes, eroded
CsB2	Crosby-Miami silt loams, 2 to 6 percent slopes, eroded
CyB2	Fincastle silt loam
Fc	Fox silt loam, 0 to 2 percent slopes
FoA	Fox silt loam, 2 to 6 percent slopes, eroded
FoB2	Fox soils, 6 to 12 percent slopes, severely eroded
FsC3	Genesee silt loam
Gh	Gravel pits
Gp	Hennepin loam, 25 to 60 percent slopes
HeE	Houghton muck, drained, 0 to 1 percent slopes
Kk	Kokomo silt loam, overwash
Ko	Kokomo silty clay loam
Lw	Made land
Ma	Miami clay loam, 12 to 18 percent slopes, severely eroded
MIb2	Miami clay loam, 2 to 6 percent slopes, severely eroded
MIC2	Miami clay loam, 6 to 12 percent slopes, severely eroded
MmB3	Miami silt loam, 2 to 6 percent slopes, eroded
MmC3	Miami silt loam, 6 to 12 percent slopes, eroded
MmD3	Morley silt loam, 2 to 6 percent slopes, eroded
MrB2	Morley silty clay loam, 2 to 6 percent slopes, severely eroded
MsB3	Morley silty clay loam, 6 to 12 percent slopes, severely eroded
MsC3	Ockley silt loam, 0 to 2 percent slopes
OcA	Ockley silt loam, 2 to 6 percent slopes, eroded
OcB2	Ockley silt loam, loamy substratum, 0 to 2 percent slopes
OKA	Ockley silt loam, loamy substratum, 2 to 6 percent slopes, eroded
OkB2	Palms muck, drained, 0 to 1 percent slopes
Pa	Patton silty clay loam, loamy substratum
Pc	Patton silty clay loam, occasionally flooded
Pe	Pewamo silty clay loam
Qu	Quarries
RuA	Russell silt loam, 0 to 2 percent slopes
RuB2	Russell silt loam, 2 to 6 percent slopes, eroded
Sh	Shoals silt loam
W	Water





**Legend**

**Draft10\_SM\_Sliver**

**Value**

	Fincastle - New America Flute
	Starks - New America Flute
	Treaty - New America Flute
	Pella - Floodplain
	Ockley - Floodplain
	Miami - Floodplain
	Morley - Floodplain
	Genessee/Shoals
	Shoals/Genessee
	Palms - Muck/Histosol
	Houghton - Muck/Histosol
	Water/Mine Spoil
	Water/Mine Spoil
	Crosby high elevation - Russiaville
	Fincastle low elevation - Russiaville
	Starks high elevation - Russiaville
	Starks low elevation - Russiaville
	Brookston - low elevation - Russiaville
	Brookston high elevation - Russiaville
	Pella - Russiaville
	Crosby - South Kokomo
	Starks - South Kokomo
	Brookston - South Kokomo
	Pella - South Kokomo
	Alfisol 1 - Washboard Moraine
	Alfisol 2 - Washboard Moraine
	Shallow Mollisol - Washboard Moraine
	Deep Mollisol - Washboard Moraine
	Alfisol 1 - Union City Moraine
	Alfisol 2 - Union City Moraine
	Alfisol 2 eroded - Union City Moraine
	Shallow Mollisol - Union City Moraine
	Deep Mollisol - Union City Moraine
	Blount - East of Moraine
	Blount eroded - East of Moraine
	Pewamo - East of Moraine
	Pewamo cumulic - East of Moraine

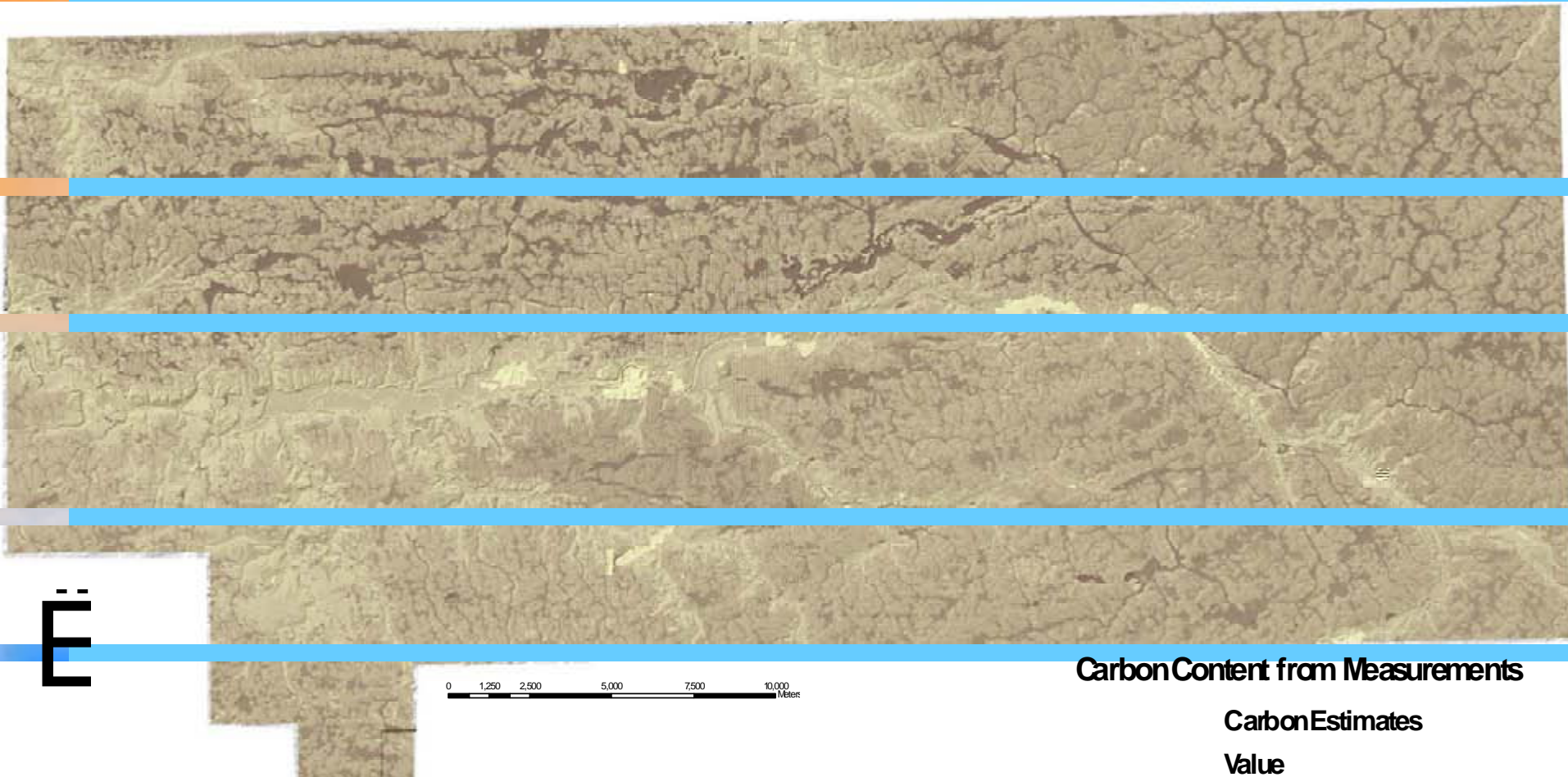
## The Accuracy assessment results of validation between TASM (Producer) and SSURGO (User), for the main soil series

Soil Series	Accuracy (%)	
	Producer	User
Fincastle	0.87	0.92
Brookston	0.90	0.77
Crosby	0.90	0.78
Blount	0.68	0.84
Powamo	0.61	0.36
Shoals	0.21	0.37
Morley	0.20	1
Patton	1	1
Miami	1	0.09
<b>Overall Accuracy (%)</b>	<b>0.77</b>	

Validation based on 460 geo-referenced points

The kappa coefficient was 0.74 suggesting that the substantial agreement between TASM and SSURGO was not random

<u>kappa</u>	<u>Interpretation</u>
< 0 —	No agreement
0.0 — 0.20	Slight agreement
0.21 — 0.40	Fair agreement
0.41 — 0.60	Moderate agreement
0.61 — 0.80	Substantial agreement
0.81 — 1.00	Almost perfect agreement





# Conclusions

- We have the tools to map gradations of soil variability;
- Terrain attributes are useful for estimating soil properties;
- Structural heterogeneity of soils can be simplified for hydrological response predictions because of functional homogeneity of soil properties.